The Patent Office
PATENTS • DESIGNS • COPYRIGHT • TRADE MARKS

29 SEP 200

INVESTOR IN PEOPLE

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

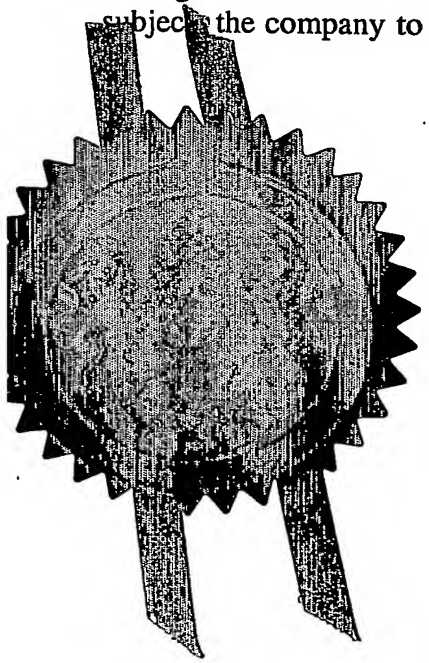
The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed

Dated 7 March 2003

Patents Form 1/77

The Patent Office

1/77

...s Act 1977
(Rule 16)

THE PATENT OFFICE
H
-5 APR 2002
LONDON

GBAPR02 E708991-5 D02882
P01/7700 0.00-0207922.6

Request for grant of a patent

See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Concept House
Cardiff Road
Newport
South Wales NP10 8QQ

Your reference	**AWP/P58881/000**
Patent application number *(The Patent Office will fill in this part)*	0207922.6
Full name, address and postcode of the or of each applicant *(underline all surnames)*	**LOTUS CARS LIMITED** **HETHEL, NORWICH** **NORFOLK NR14 8EZ**
Patents ADP number *(if you know it)*	5739743001
If the applicant is a corporate body, give the country/state of its incorporation	**ENGLAND**
Title of the invention	**A METHOD OF MANUFACTURE OF AN AUTOMOBILE STRUCTURE AND AN AUTOMOBILE STRUCTURE MADE BY THE METHOD**
Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	**BOULT WADE TENNANT** **VERULAM GARDENS** **70 GRAY'S INN ROAD** **LONDON WC1X 8BT**
Patents ADP number *(if you know it)*	**42001**

If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number (if you know it)	Date of filing *(day/month/year)*

If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

Is a statement of inventorship and of right to grant of a patent required in support of this request? **YES**

(Answer 'Yes' if:
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	7
Claim(s)	5
Abstract	-
Drawing(s)	9 + 9

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(Please specify)*	

11 I/We request the grant of a patent on the basis of this application.

Signature

Date 5 April 2002

12. Name and daytime telephone number of person to contact in the United Kingdom **MR.A.W.PLUCKROSE 020 7430 7500**

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed i it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents ct 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless a application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 01645 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

A METHOD OF MANUFACTURE OF AN AUTOMOBILE STRUCTURE AND AN AUTOMOBILE STRUCTURE MADE BY THE METHOD

The present invention relates to a method of manufacture of an automobile structure and to an automobile structure made by the method.

Automobile structures such as rolling chassis, chassis tubs and other types of platform have traditionally been constructed by methods which make variations very difficult. Different automobiles may share a common platform, but the platform itself is of a fixed shape and configuration. Whilst this has suited the needs of mass automobile manufacture the known methods are not ideal for low volume manufacturers because of their inflexibility.

The present invention provides in a first aspect a method of manufacture of an automobile structure comprising the steps of:

forming in a die a plurality of castings each having at least one open socket;

extruding a plurality of metallic rails; and

fixing the extruded metallic rails in the open sockets of the castings in order to construct the automobile structure.

The present invention provides in a second aspect a method of manufacture of a plurality of different automobile structures comprising:

forming in a die a plurality of identical castings;

forming a first length of metallic extrusion of a first chosen cross-section;

cutting the first length of metallic extrusion into a first plurality of side rails for an automobile each with the same first length;

cutting the metallic extrusion into a second plurality of side rails for an automobile each with the same second length different to the first length;

joining the metallic rails of the first plurality with a plurality of the castings to form a first type of automobile structure; and

joining the metallic rails of the second plurality with a plurality of castings to form a second type of automobile structure.

A preferred method of manufacture of an automobile structure will now be described with reference to the accompanying drawings which show component parts used in the method as follows:

Figure 1 shows a first assembled joint of an automobile structure according to a method of the present invention;

Figure 2 is a first detail view of a part of the joint illustrated in Figure 1;

Figure 3 is a second detail view of a part of the Figure 1 joint;

Figure 4 is a third detail view of the joint of Figure 1;

Figure 5 is a first view of a structural member for use in a method of manufacture according to the present invention;

Figure 6 is a second view of the structural member of Figure 5;

Figure 7 is a first view of a second assembled joint of an automobile structure manufactured according to the present invention;

Figure 8 shows a second view of the assembled joint of Figure 7; and

Figure 9 is a schematic plan view of an automobile structure made by a method according to the present invention which has structural members as shown in Figures 5 and 6 and has joints as shown in Figures 7 and 8.

Turning first to Figure 1 there can be seen a casting 10 to which are joined a front bulkhead of a vehicle (comprising a transverse rail 11A and transversely extending support structure 11B), a side rail 12 and a side rail 13. The transverse rail 11A and the side rails 12 and 13 are extrusions, typically of an aluminium alloy. The side rail 12 extends rearwardly of the first bulkhead to join the casting 10 to another similar casting (not shown) to which is attached a rear bulkhead (not shown, but similar to the front bulkhead 11A and 11B). The side rail 13 extends forwardly of the first bulkhead to provide support for an engine (on a front-engined vehicle), the crash structure of the vehicle (not shown) and one of the front suspension assemblies of the vehicle (not shown). The side rails 12, 13 and the transverse rail 11A are all bonded to the casting 10.

Figure 2 shows in detail a part of the casting 10. The casting 10 has as an integral feature an open socket 14 having a pair of parallel spaced apart planar surfaces 15 and 16. The side rail 12 is a box section extrusion (see Figure 3). The front end of the side rail is cut at an angle to leave a pair of parallel spaced apart planar surfaces 17 and 18. The planar surface 18 is formed from part of a surface which was initially an interior surface of the box

section extrusion, prior to cutting of the extrusion.

The planar surfaces 17 and 18 are respectively adhered to the planar surfaces 15 and 16 of the open socket 14. The resulting joint can be seen in Figure 4. A cover (not shown) will be fixed across the joint to close the open socket.

A second embodiment of casting 30 is shown in Figures 5 and 6. The casting 30 is simplified in comparison with the casting 10. It has an open socket section 31 as an integral feature. The socket section 31 has a flat surface to allow good adhesion of a side rail in the socket section 31. The remainder of the casting 30 has surface ribbing to provide good strength. A flange 32 extends from the upper edge and around the front edge. In Figure 5 it can be clearly seen that the socket section 31 of the casting 30 immediately after casting has a stepped height feature. A part of the socket section 31 nearest the rearward edge has a first height h_1 and then a part inward of the rearward edge has a second greater height h_2. This feature is arranged to provide the casting with a degree of flexibility. A designer for a first vehicle may choose to have a side rail with a first sill height h_1 while for a second vehicle a larger sill height h_2 may be required. A simple cutting operation can convert the open socket 31 from a socket for receiving a sill of height h_1 to a socket for a sill of height h_2. Thus in a method according to the present invention a single casting is provided with a number of different features, e.g. socket heights which will not all be used in a single automobile structure. Instead a selection can be made.

Figures 7 and 8 show the casting 30 in use. First of all it will be seen that the lower height part of the socket section 31 has been removed. A generally L-shaped side rail 37 is adhered in the open socket section 31. A floor section 33 of the automobile structure is adhered to a flange 34 extending from the lower edge of the casting 30 (see Figure 8). Ghosted in the Figure 7 is an "A" pillar support structure 39. Forward of the "A" pillar support structure 39 a sheet metal cover plate (not shown) will be adhered to the flange 32 of the casting 30 and to a flanged edge 35 of the floor section 33 (see Figure 7). Thus, two sides of a box are defined by the casting 30 and two sides by the floor section 33 and the cover plate (not shown) (both made from sheet metal). A sheet metal plate 36 can be seen adhered to a flanged edge of the floor section 33, to the flange 32 of the casting 30 and to an edge of the L-shaped side rail 37.

The casting 30 is shaped to curve inwardly towards the centre of the vehicle structure. The lateral distance by which the front edge is displaced from the rear edge will be varied from casting to casting. In extremis, the displacement can be such as to give the arrangement shown schematically in Figure 9. In the figure two castings 30 help to define a floorpan for a 'diamond shaped' seating arrangement in which a driver 40 sits foremost, two passengers 41, 42 sit both laterally and rearwardly displaced from the driver 40 and a third passenger 43 sits immediately behind the driver. This can provide a very efficient use of the overall length of a vehicle. The distance L_1 shown in the figure is the distance which must be allowed to provide an adequate crumple zone for a

direct frontal impact. For an off-centre impact a longer distance L_2 is required. Generally with the conventional driver and passenger side-by-side arrangement the distance L_2 must be allowed across the whole of the vehicle (at the front and the rear) and so the length of the vehicle is the sum of 2 x L_2 + (room for driver and passenger to sit one behind the other). However, in the new arrangement the length of the vehicle is less because it is the sum of 2 x L_1 + (room for driver and passenger to sit one behind the other).

The use of open sockets which are closed by closing plates removes the need for high tolerances which can be achieved only by expensive machining processes. The casting 10 and 30 will typically be of die cast aluminium alloy, perhaps of an alloy with magnesium. The castings 10 and 31 function as parts defining the structure and not just as connecting nodes.

The invention recognises that it is best to use aluminium and alloys thereof for components formed either by casting or by extrusion since pressing of aluminium and aluminium alloys is difficult. Nodes with closed sockets used in previous designs have typically been steel pressings.

It is envisaged that the side rails will be first fixed in place in the open sockets in the castings by mechanical fixings such as EJOT screws or bolts. Then adhesive will be injected into defined gaps (perhaps of depths defined by surface features on the castings and/or the extrusions). The mechanical fixings will be left in place to prevent peeling of the adhesive.

The automobile structure formed by the method described above is a self-supporting structure which provides the primary strength to the automobile and is not simply supply a cladding structure. Bodywork cladding will be joined to and supported by the structure formed by the invention.

The method of the present invention allows great flexibility in design of an automobile structure because the side rails and the transverse rails are formed by cutting sections from long extrusions. The sections can be of any chosen length. The cast nodes are common to all designs. Thus without any additional tooling expenditure the designer can choose long length extrusions for the longitudinal side rails of a four/five passenger vehicle and shorter length extrusions as the side rails of a two-seater vehicle. Similarly transverse rails can be chosen to have different lengths so that the vehicle width can easily be varied. Also, as mentioned above, by designing in each casting the possibility for different size sockets a large section extrusion can be chosen for a high-silled off-road vehicle while a small section extrusion can be chosen for a low-silled sports car.

CLAIMS

1. A method of manufacture of an automobile structure comprising the steps of:

forming in a die a plurality of castings each having at least one open socket;

extruding a plurality of metallic rails; and

fixing the extruded metallic rails in the open sockets of the castings in order to construct the automobile structure.

2. A method as claimed in claim 1 wherein:

four castings are formed which in the finished structure are located one each at the four corners of a generally rectangular cabin of the automobile; and

two of the metallic rails are side rails which extend longitudinally parallel to each other on opposite sides of the cabin each between a different pair of castings, each side rail being fixed at each end in an open socket of a casting.

3. A method as described in claim 1 or claim 2 which additionally comprises:

forming at least one casting initially with features capable of defining a plurality of different sizes of open sockets;

selecting a size of cross-section of an extruded rail; and

machining the casting to provide the casting with an open socket appropriate for the selected extruded rail.

4. A method as claimed in any one of the preceding claims comprising fixing the metallic rails in the open sockets by bonding with adhesive.

5. A method as claimed in claim 4 wherein the metallic rails are initially secured in place in the open sockets by mechanical fasteners and then adhesive is injected in gaps left between the rails and the sockets.

6. A method as claimed in claim 4 or claim 5 wherein a closing plate is used to complete each open socket.

7. A method as claimed in claims 4,5 or 6, comprising:

forming in at least one casting an open socket having a pair of parallel spaced apart planar surfaces extending between side walls common to both;

extruding a rectangular cross-section hollow metal rail;

cutting away three of the four walls from an end section of the hollow metal rail to leave exposed a planar surface which was originally an interior surface of the hollow metal rail; and

adhering the exposed planar surface of the metal rail to one of the parallel spaced apart planar surfaces of the casting and adhering to the other planar surface of the casting a part of an exterior surface of the hollow rail which is parallel to and spaced apart from the exposed planar surface of the hollow rail.

8. A method as claimed in any one of claims 1 to 6 wherein at least one metallic rail is formed as an open-section rail and in the method a cover plate is bonded to the open-section metallic rail to close the section.

9. A method as claimed in claim 8 wherein the open-

section rail is bonded additionally to a floor panel and the cover plate s bonded to both the floor panel and the metallic rail in order to form a closed-section structure extending along a side of the vehicle.

10. An automobile comprising a chassis formed by the method of any one of the preceding claims, the chassis providing the primary structural rigidity of the vehicle and the automobile having exterior body panels overlaying the chassis.

11. An automobile as claimed in claim 10 which has cabin with a diamond shaped floor pan and seats for a driver and three passengers; a driver's seat located forward of the other seats and centrally widthwise of the vehicle; two passengers' seats located rearwardly of the driver's seat and each spaced transversely outwardly from the driver's seat; and a fourth passenger seat located rearwardly of the other three seats and directly behind the driver's seat.

12. A casting formed in a method of manufacture as claimed in any one of claims 1 to 9.

13. An extruded metallic rail formed in a method of manufacture as claimed in any one of claims 1 to 9.

14. A method of manufacture of a plurality of different automobile structures comprising:

forming in a die a plurality of identical castings;

forming a first length of metallic extrusion of a first chosen cross-section;

cutting the first length of metallic extrusion

into a first plurality of side rails for an automobile each with the same first length;

cutting the metallic extrusion into a second plurality of side rails for an automobile each with the same second length different to the first length;

joining the metallic rails of the first plurality with a plurality of the castings to form a first type of automobile structure; and

joining the metallic rails of the second plurality with a plurality of castings to form a second type of automobile structure.

15. A method as claimed in claim 14 wherein the castings are each formed with features defining a first size of open socket and having features capable of defining a second different size of open sockets, and the method additionally comprises:

forming a second length of metallic extrusion of a second chosen cross-section;

cutting the second length of metallic extrusion into a third plurality of side rails for an autombile each with the same third length;

cutting the second length of metallic extrusion into a fourth plurality of side rails for an automobile each with the same fourth length different to the third length;

machining after casting some of the identical castings to provide a first plurality of the castings with open sockets of the second size, while laving others of the identical castings unmachined to provide a second plurality of castings; and

selecting between the plurality of castings and the plurality of side rails and joining together side rails with castings where the sizes of the open sockets of the castings match the cross-sections of

the side rails in order to form a plurality of different automobile structures from a common set of initial castings and metallic extrusions.

: 344731: AWP:21 December 2001

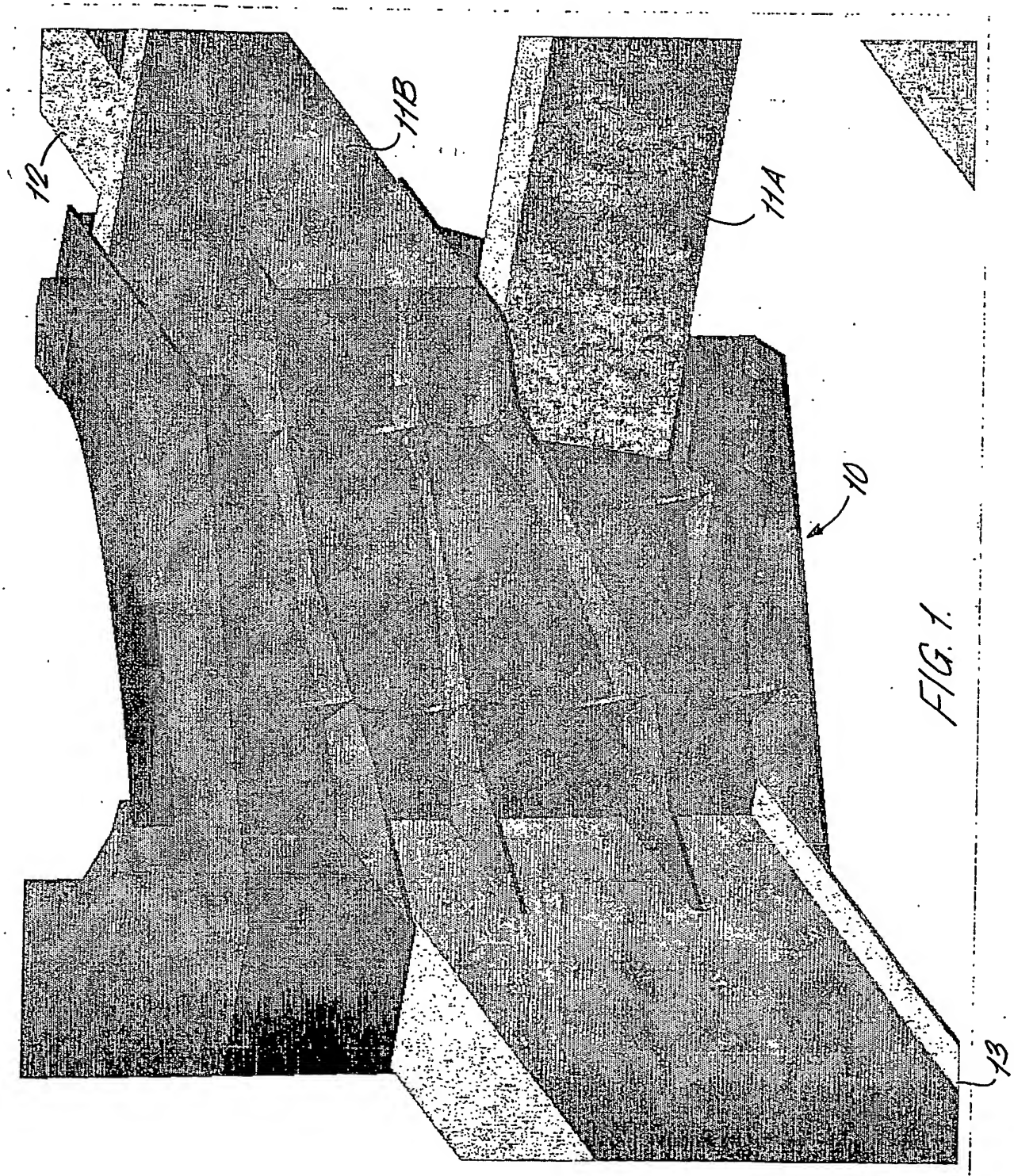


FIG. 1.

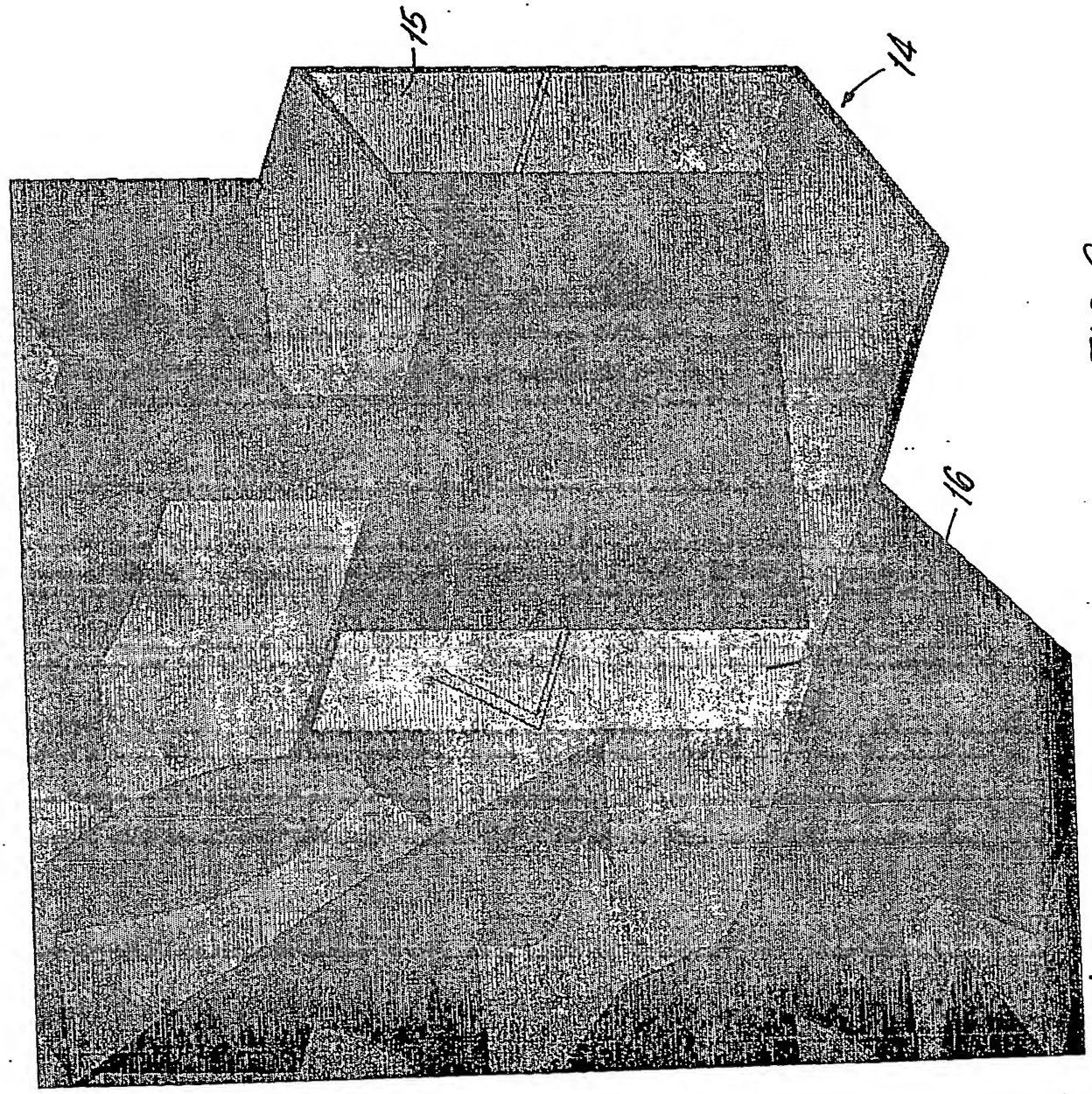


FIG. 2.

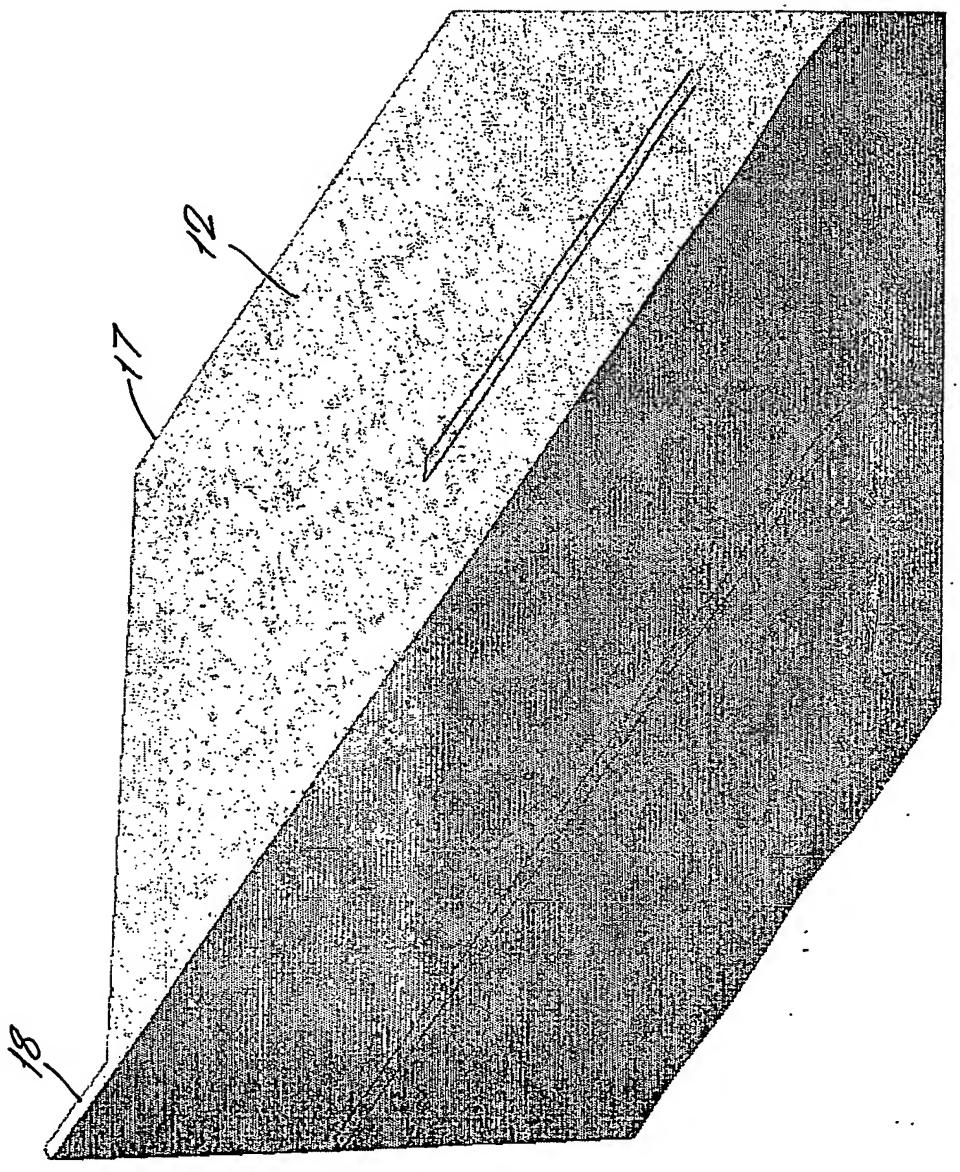
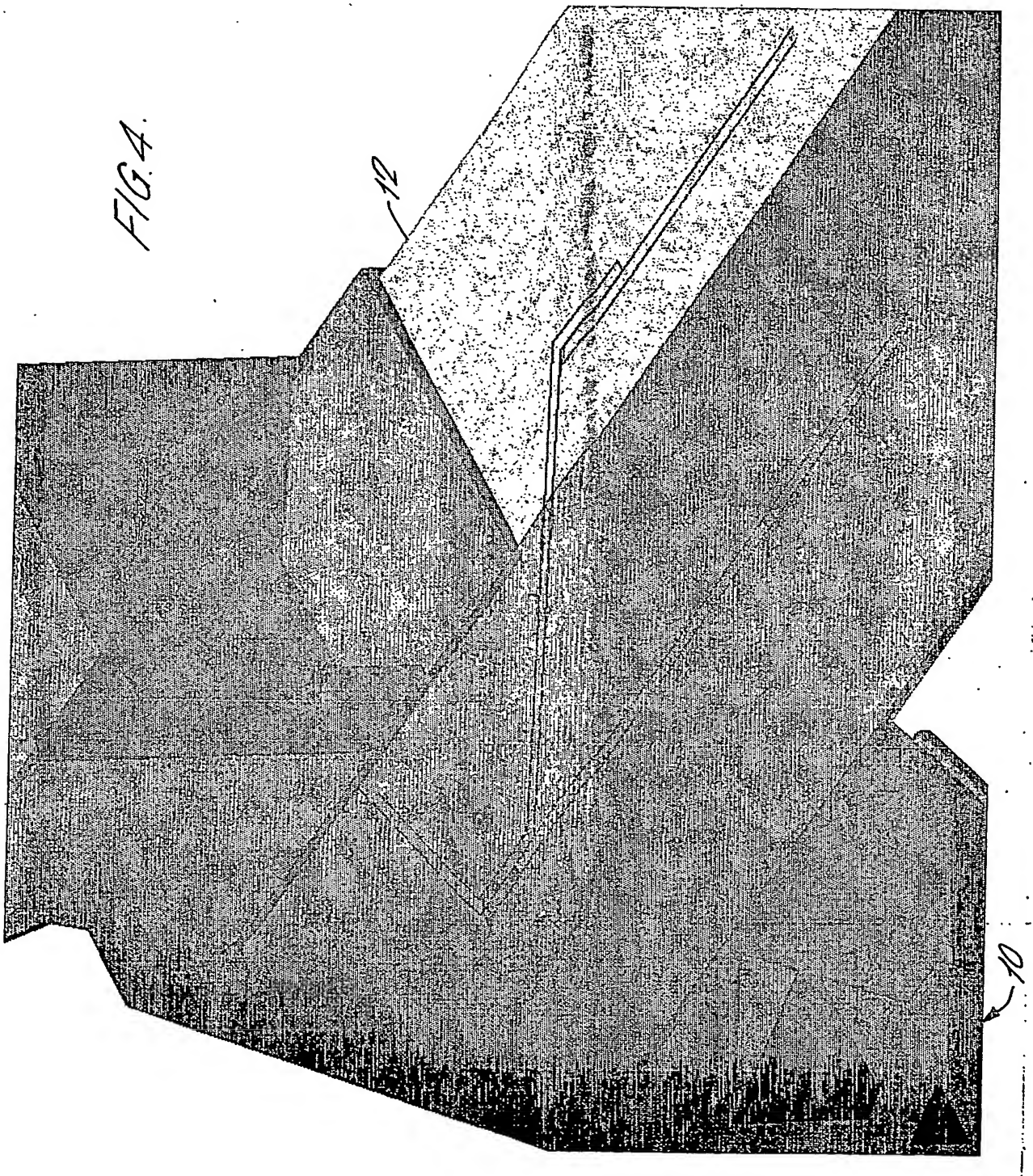


FIG. 3.

FIG.4.



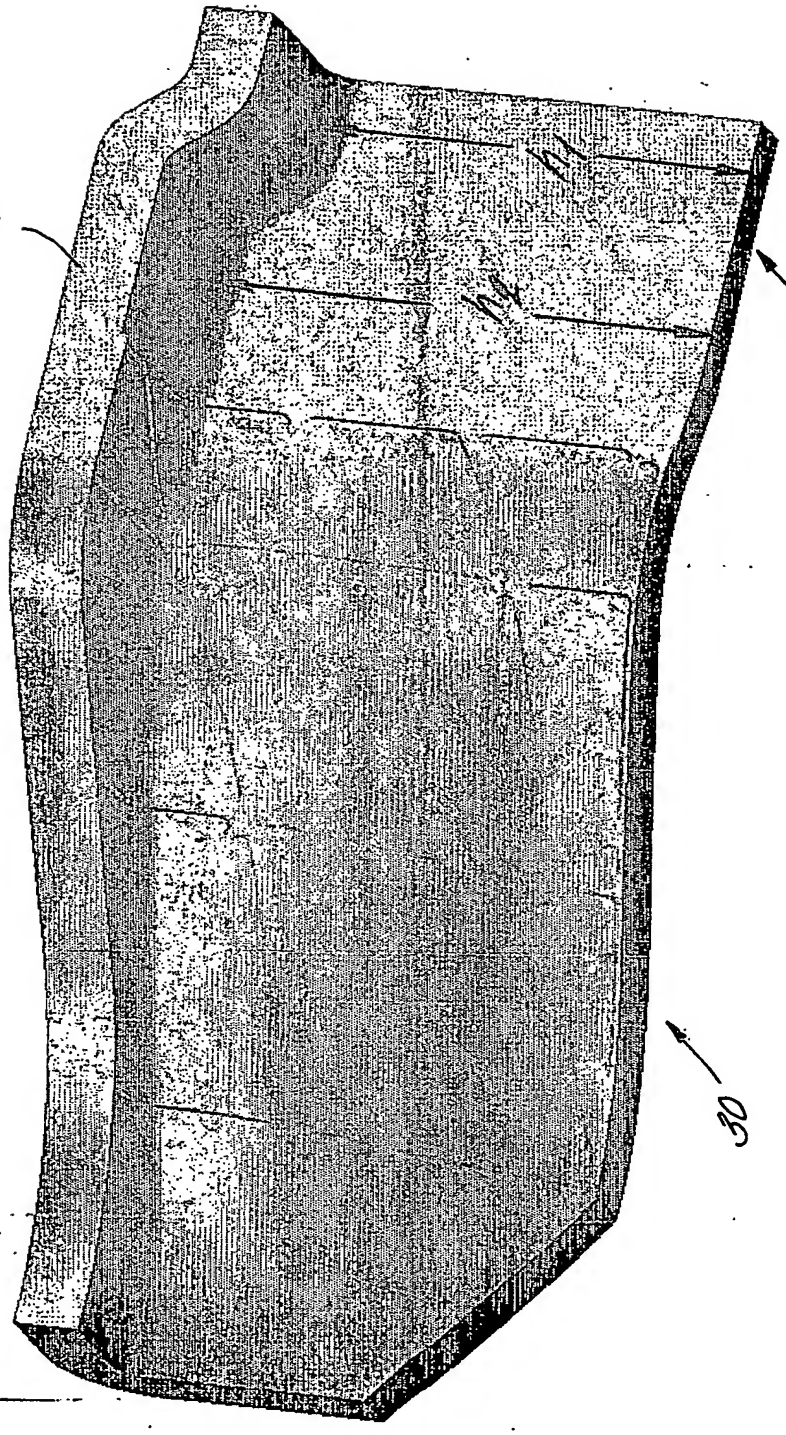


FIG. 5.

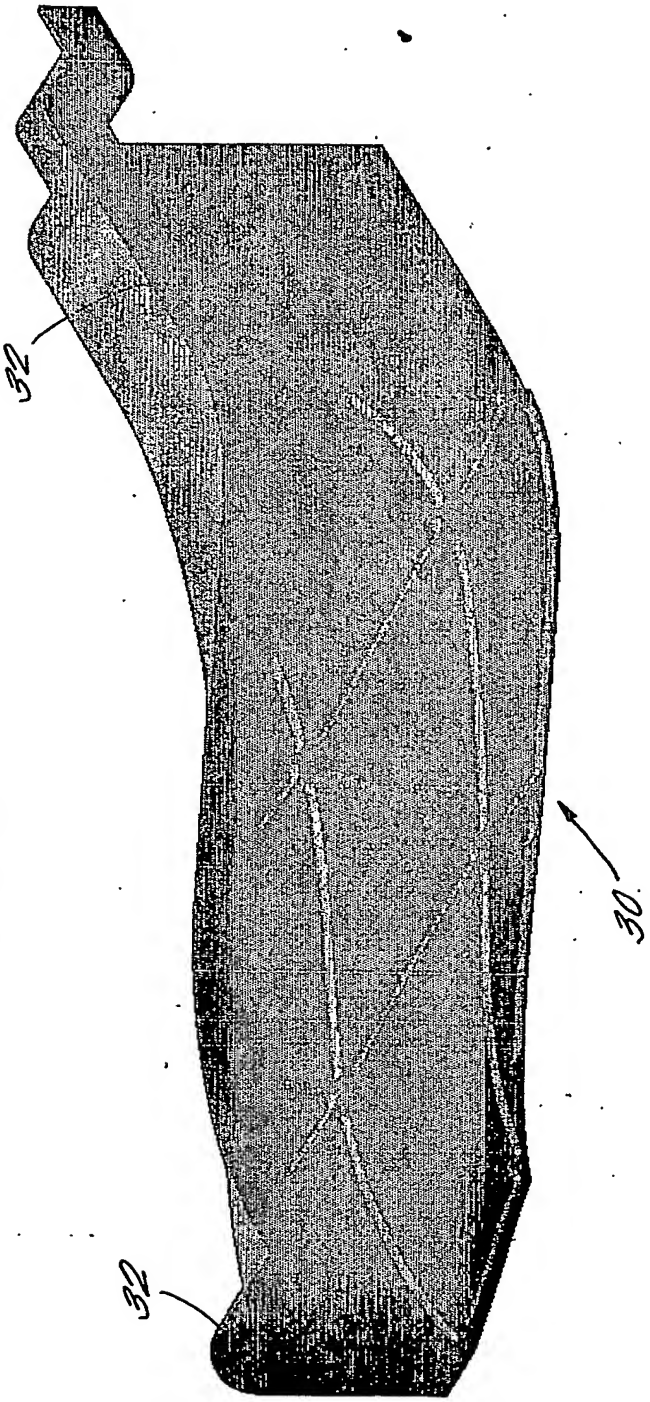


FIG. 6.

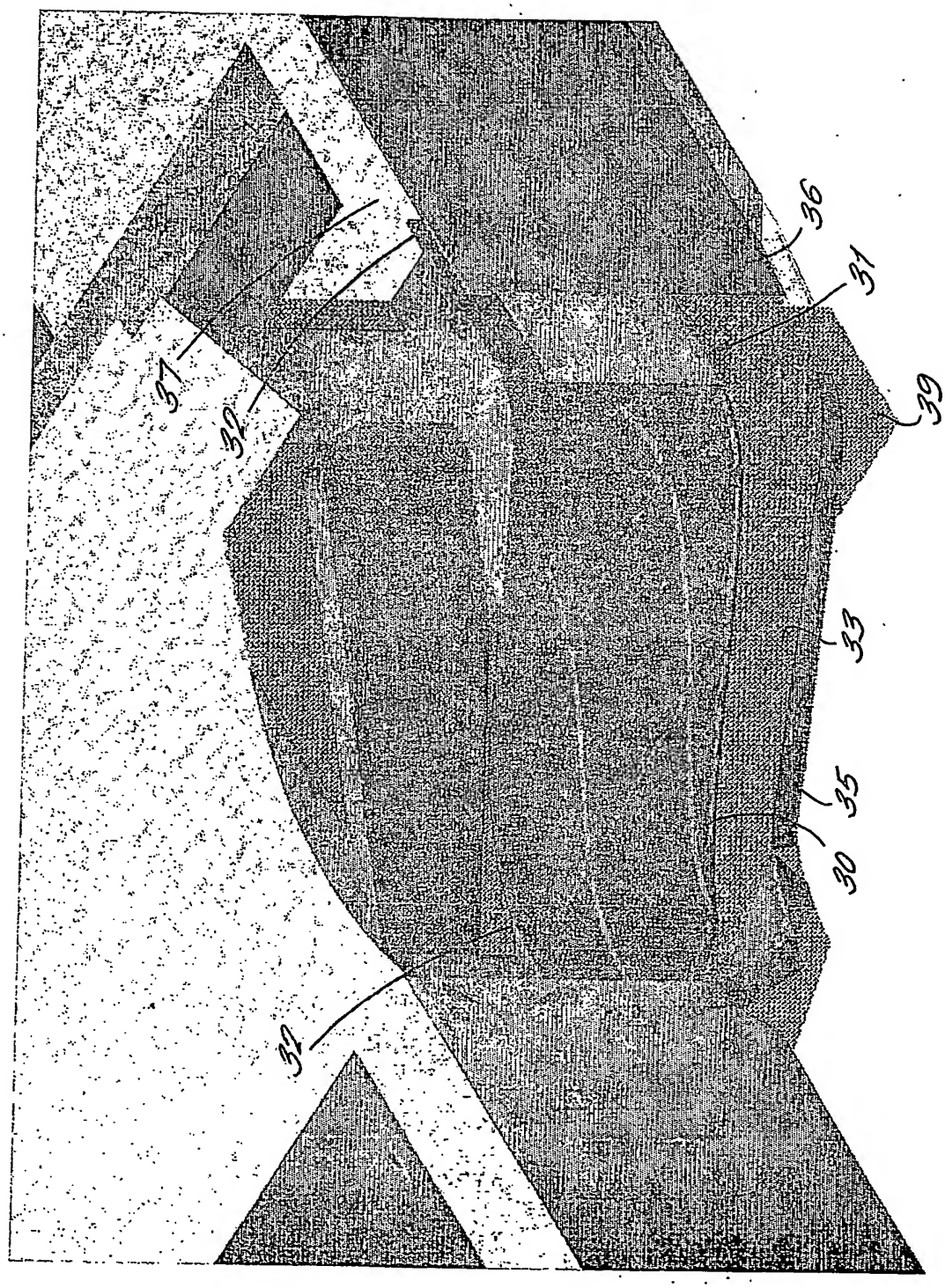


FIG. 7.

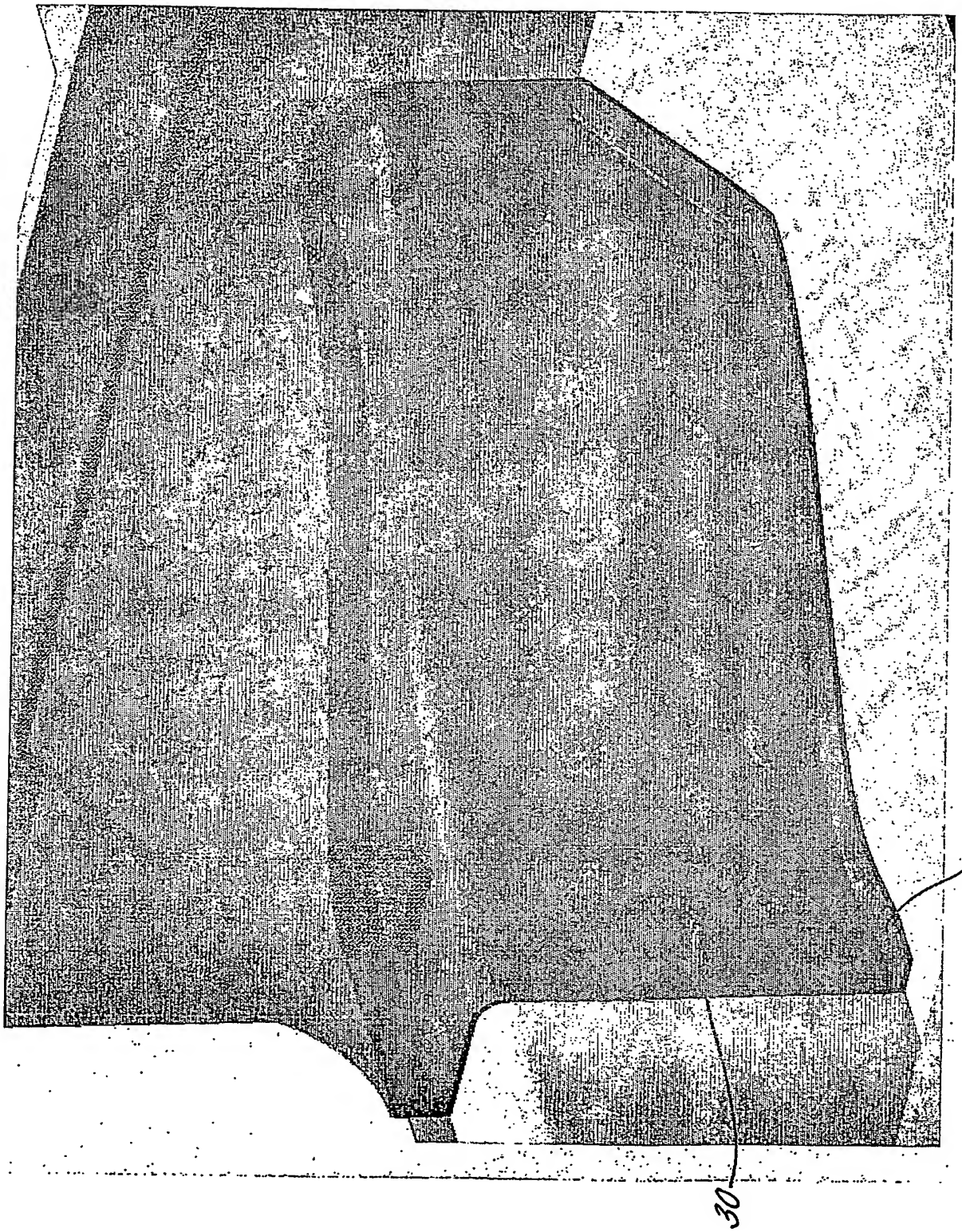


FIG. 8.

FIG. 9.